ARGOSystems

# OPERATION AND MAINTENANCE MANUAL

INSTRUMENTATION AND METROLOGY DIVISION

M86-0003

# AS211
# RUBIDIUM FREQUENCY DISTRIBUTION SYSTEM

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# SECTION 1
# GENERAL INFORMATION

## 1.1 INTRODUCTION

The AS211 Rubidium Frequency Distribution System (hereinafter referred to as the AS211) is an extremely stable, self-contained frequency source with multiple outputs. The AS211 provides buffered, amplified, standard reference frequencies based on the internal Rubidium cell. The available frequencies of 1, 5, and 10 MHz are installed as options in blocks of four outputs for each frequency selected and may be installed in any combination up to the maximum of 16 total outputs. These outputs were designed as external frequency reference sources for other crystal-controlled instruments, such as electronic counters, clocks, and synthesizers.

## 1.2 PHYSICAL AND ELECTRICAL DESCRIPTION

The AS211 is constructed in a standard 5-1/4- by 19-inch rack-mountable chassis (see Figure 1-1). An option is also available to convert the rack-mountable chassis to a 5-1/4- by 17-inch stand-alone chassis. The top cover may be removed by removing the rear panel's two upper screws, which hold the panel in place. The power supply circuit, consisting of the rectifier transformer, bridge rectifier, filter capacitors, and DC/DC converter, is mounted on the mounting baseplate that covers the bottom of the unit. The Rubidium cell, waveform generator board, two of the four possible output frequency options, and a bracket holding the other two output frequency option possibilities are also installed on the mounting baseplate. Note that all of the output frequency options may not be installed if the unit is not fully configured.

Figure 1-1 AS211 Rack Mount Chassis

The AC input RFI filter and fuse, front panel power switch, external 28-volt input connector, external 28-volt fuse, external 28-volt reversed LED indicator, front panel frequency adjustment, and the Rubidium cell are all hard wired in a harness assembly. The waveform generator and optional frequency output boards are powered by two-pin cable connectors. The waveform generator's outputs connect to the appropriate frequency option board and also provide power to the front panel phase-lock LED. The outputs from the frequency option board amplifiers are wired to the rear panel output connectors.

## 1.3 SPECIFICATIONS

Table 1-1 is a complete list of specifications for the AS211.

Table 1-1
AS211 SPECIFICATIONS

| ELECTRICAL | | |
|---|---|---|
| FREQUENCY STABILITY | | |
| TIME | | |
| LONG-TERM + | 1 PART IN $10^{11}$ | |
| SHORT-TERM | 1 SEC | 1 PART IN $10^{11}$ |
| | 100 SEC | 1 PART IN $10^{12}$ |
| TEMPERATURE | | |
| 0 TO 40°C | | $\pm$5 PARTS IN $10^{11}$ |
| VIBRATION AND SHOCK | | $\pm$5 PARTS IN $10^{11}$ |
| + 10% LINE VOLTAGE VARIATION | | $\pm$5 PARTS IN $10^{11}$ |

Table 1-1 (Continued)
AS211 SPECIFICATIONS

| ELECTRICAL | |
|---|---|
| WARM-UP CHARACTERISTICS | |
| 10 MINUTES | $\pm 1$ PART IN $10^{10}$ |
| 20 MINUTES | $\pm 5$ PARTS IN $10^{11}$ |
| SETABILITY | |
| ADJUST RANGE | $\pm 2$ PARTS IN $10^{9}$ |
| ADJUST RESOLUTION | $\pm 2$ PARTS IN $10^{12}$ |
| PHASE NOISE (OFFSET FROM 5-MHz SIGNAL) | |
| 10 Hz = | 120 dB |
| 100 Hz = | 145 dB |
| OUTPUTS (LEVEL INDIVIDUALLY ADJUSTABLE 0.5- TO 2.0-V RMS): | |
| OPT 1: | 8 x 10 MHz |
| OPT 2: | 8 x 5 MHz |
| OPT 3: | 4 x 10 and 4 x 5 MHz |
| POWER REQUIREMENTS | 110 V ac, 28 V dc |

| ENVIRONMENTAL | | |
|---|---|---|
| PARAMETERS | OPERATING | NONOPERATING |
| TEMPERATURE | 0 TO 40°C | -55°C TO +75°C |
| ALTITUDE | TO 15,000 FT | TO 40,000 FT |
| HUMIDITY | 0 TO 85% NC | 0 TO 95% NC |

| PHYSICAL | |
|---|---|
| WIDTH | 19 IN. |
| HEIGHT | 5.25 IN. |
| DEPTH | 9 IN. (EST.) |
| WEIGHT | 16 LBS. (EST.) |

NOTE: SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

# SECTION 2
# INSTALLATION

## 2.1 INTRODUCTION

The AS211 is a self-contained unit that requires a source of 115-V ac prime power or 28 V dc. Figure 2-1 shows the rear panel controls and indicators. The polarity-keyed, external 28-V dc two-pin connector located on the rear panel may be used to power the AS211 or, if applied when 115 V ac is present, a 28-V dc battery will serve as a power back-up during ac power failures or "brown-outs" caused by low ac line voltages. Note that 28 volts is a nominal value and that the unit will operate correctly on any dc voltage from 22 to 32 volts. If the proper polarity on the external 28 V dc is not observed, the red +28 V DC REVERSED LED will light. During normal operation, this indicator should be off. The 5-amp circuit protection fuse for the external 28 V dc is located next to the +28-V dc input connector.

## 2.2 RACK MOUNTING PROCEDURE

The AS211 rack-mountable chassis is constructed for operation in a standard 19-inch-wide rack that has 2-1/4 inch hole spacing. At least 5-1/4 inches of vertical space are required to mount this instrument in the rack. If other instruments are operated in the rack, an additional 1/2 inches are required, both above and below the AS211, to allow space for proper circulation of cooling air.

# SECTION 3
# OPTIONAL CIRCUITRY INSTALLATION

## 3.1 INTRODUCTION

There are three optional circuits available for the AS211. All are complete kits that may be field installed through careful reading of this section by anyone possessing a minimal amount of electronic experience. The three options are as follows: the 1-MHz Option, No. 152133; the 5-MHz Option, No. 152134; and the 10-MHz Option, No. 152135. Each option provides four outputs at the selected frequency.

## 3.2 INSTALLATION OF THE 1-, 5-, AND 10-MHz OPTIONS

**WARNING**

Remove both the 115-V ac and the +28-V dc power from the AS211 before attempting to install the option, or electrical shock may result.

### 3.2.1 Tools Required

The following is a list of tools required to install the output frequency option:

1. Phillips screwdriver
2. Wrench
3. Soldering iron
4. Solder
5. 22-AWG wire strippers

### 3.2.2 Output Frequency Option Contents

Table 3-1 lists the contents of the output frequency option kit. Make sure that your kit contains all these items.

Table 3-1
CONTENTS OF OUTPUT FREQUENCY OPTION KIT

| ITEM | QTY | DESCRIPTION | PART NUMBER |
|---|---|---|---|
| 1 | 1 | 1-MHz PRINTED CIRCUIT BOARD | 152078 |
| | | 5-MHz PRINTED CIRCUIT BOARD | 152079 |
| | | 10-MHz PRINTED CIRCUIT BOARD | 152080 |
| 2 | 1 | TWO-WIRE POWER CABLE | 152090 |
| 3 | 1 | SHIELDED RF INPUT CABLE | 152115 |
| 4 | 4 | SHIELDED RF OUTPUT CABLE | 152085-01 |
| 5 | 1 | 1-MHz LEXAN FREQUENCY ID LABEL | 152130 |
| | | 5-MHz LEXAN FREQUENCY ID LABEL | 152131 |
| | | 10-MHz LEXAN FREQUENCY ID LABEL | 152132 |
| 6 | 4 | #4-40 X 3/8-IN. MOUNTING SCREWS | MS51957-15 |
| 7 | 4 | #4 FLAT WASHERS | NA620-C4 |
| 8 | 4 | #4 SPLIT LOCK WASHERS | MS35338-135 |
| 9 | 4 | WASHERS | PART OF 152085-01 |
| 10 | 4 | NUTS | PART OF 152085-01 |
| 11 | 1 | 12-IN. 22-AWG WIRE | |

### 3.2.3 Finding the Option Installation Locations

The first step in determining the option installation location is to remove the top cover of the AS211. First, remove the two screws that hold the cover in place. These screws are located along the upper edge of the rear panel. Then, slide the cover off by pulling it away from the rear panel. The option may be installed in one of two areas (see Figure 3-1): (1) on the buffer amplifier mounting bracket (see Section 3.2.4) or (2) below this bracket on the mounting baseplate (see Section 3.2.5). Both locations are near the rear panel.

### 3.2.4 Upper Mounting of the Output Frequency Option

To install the output frequency option so the outputs are in the upper row on the rear panel, the option board must be mounted on the buffer amplifier mounting bracket. To do this, first position the option board onto the four #4-40 standoffs located on the top side of the buffer amplifier mounting bracket. Make sure that the output connectors (J2, J3, J4, and J5) are near the rear panel, and that the output level adjustment variable resistors trimming screws slip into the adjustment holes on the rear panel. Next, use the #4-40 x 3/8 screws provided, along with a lock washer and a flat washer on each screw, and secure each of the option board's four corners to the standoffs. The output frequency option board is now mounted inside the chassis.

#### 3.2.4.1 Installation of Frequency ID Label and Output Connectors

The next step is to install the frequency ID label and the output connectors onto the rear panel. First, the chrome plugs that cover the desired option output positions must be removed from the rear panel. To do this, straighten the plug's two "teeth" that are bent over on the inside of the rear panel, and push the plug out from the inside of the chassis. Next,

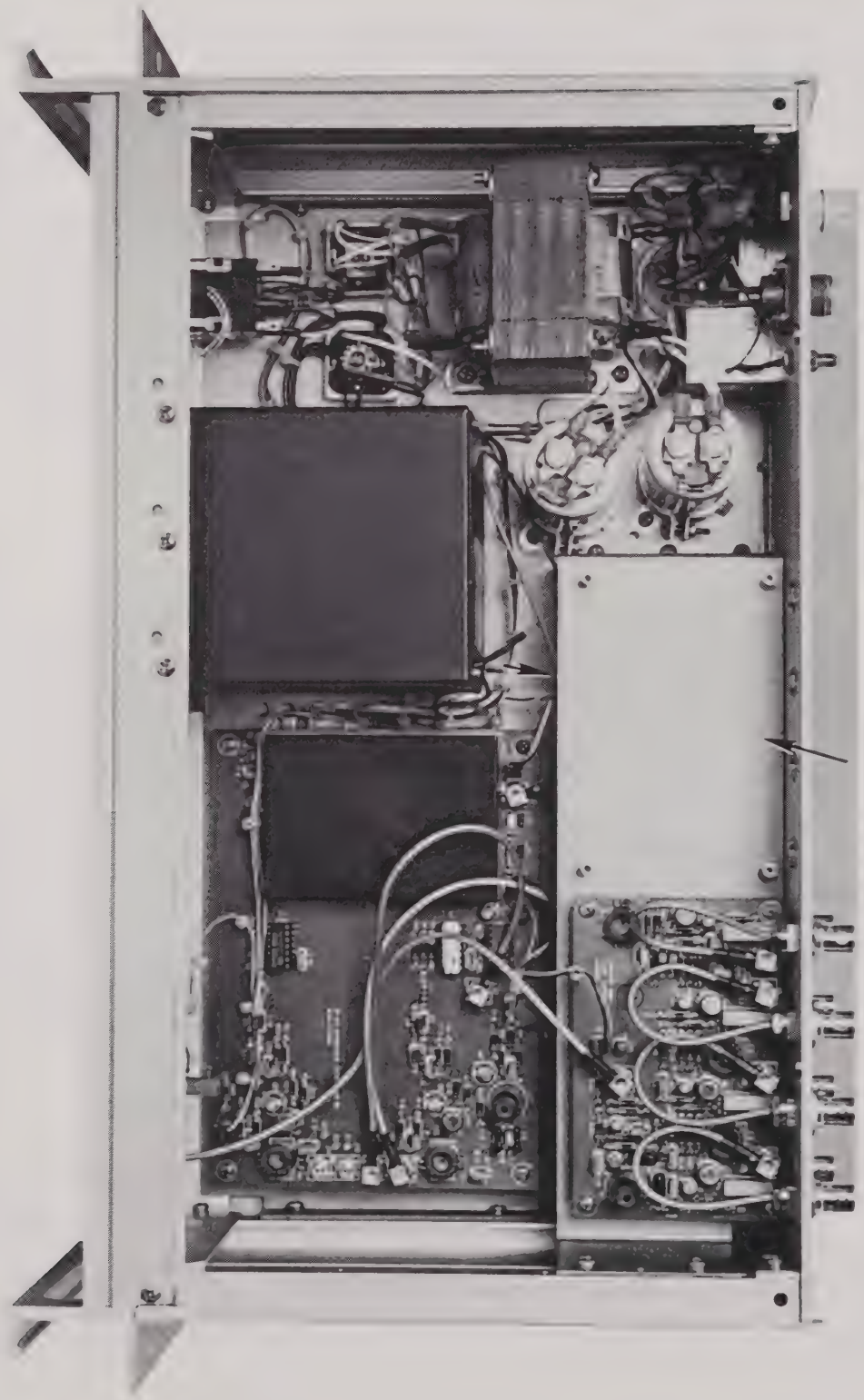

Figure 3-1 AS211 Output Frequency Option Installation Locations

peel the waxed paper backing off the frequency ID label, line up the holes in the Lexan label with the holes of the desired option location on the rear panel, and firmly press the label in place. Then, locate the four RF output cables, and press the BNC portion of each cable through its hole in the rear panel, from the inside of the chassis. Secure each connector in place on the outside of the rear panel by using the provided locking washers and nuts. Connect each RF output cable's SMB connector to the nearest connector (J2, J3, J4, or J5) on the option board.

3.2.4.2 Connection of dc Power and RF Input

The next step is to connect the dc power and the RF input from the newly installed option board to the factory-installed waveform generator board. The dc power cable is the two-wire cable with a two-pin, polarity-keyed connector on each end. Plug one end of the cable into J1 on the frequency option board and the other end of the cable into J10, J11, J12, or J13 on the waveform generator board. The RF input cable is the shielded cable with an SMB connector on each end. Plug one end of the cable into J1 on the frequency option board and the opposite end into J3, J4, J5, or J6 on the waveform generator board.

3.2.4.3 Installation of Jumper

The final step is to jumper the correct frequency on the waveform generator board to the waveform-generator-board connector that was selected to provide the RF input to the option board. First, solder the jumper to the E-pad required for the desired output frequency (see Step A in Table 3-2). For example, if the output frequency option that was installed is 10 MHz, then solder the added jumper to either Pad E1 or E2. The jumper wire provided, which is 22 AWG, should be used.

Table 3-2
JUMPER INSTALLATION OPTIONS

| A. OPTION FREQUENCY | CORRESPONDING E-PAD ON WAVEFORM GENERATOR BOARD |
|---|---|
| 1 MHz | E5 OR E6 |
| 5 MHz | E3 OR E4 |
| 10 MHz | E1 OR E2 |

| B. WAVEFORM GENERATOR BOARD RF OUTPUT | CORRESPONDING E-PAD ON WAVEFORM GENERATOR BOARD |
|---|---|
| J3 | E7 |
| J4 | E8 |
| J5 | E9 |
| J6 | E10 |

After soldering is completed at the E-pad required for the desired output frequency, solder the opposite end of the jumper to E7, E8, E9, or E10, whichever is directly above the connector (J3, J4, J5, or J6) that connects the RF input to JI on the output frequency option board (see Step B in Table 3-2). Then replace the top cover. This step concludes the installation of the output frequency option board.

### 3.2.5 Lower Mounting of the Output Frequency Option

To install the output frequency option so the outputs are in the lower row on the rear panel, the option board must be mounted on the mounting baseplate below the buffer amplifier mounting bracket. To do this, first the buffer amplifier mounting bracket should be removed for access. To do this, remove the three screws on the mounting baseplate and the three screws on the side panel. Carefully disconnect the output connectors (J2, J3, J4, and J5) from any boards mounted on the bracket, noting their positions. Then fold the mounting bracket out of the way so adequate clearance exists to the standoffs on the baseplate. Position the option board onto the four #4-40 standoffs located on the top side of the mounting baseplate. Make sure that the output connectors (J2, J3, J4, and J5) are near the rear panel and that the output level adjustment variable resistors' trimming screws slip into the adjustment holes on the rear panel. Next, use the #4-40 x 3/8 screws provided, along with a lock washer and a flat washer on each screw, and secure each of the option board's four corners to the standoffs. The output frequency option board is now mounted inside the chassis.

Next, proceed as described in Sections 3.2.4.1 and 3.2.4.2. Then reinstall the mounting bracket, and reconnect the output cables. Conclude the installation by proceeding as described in Section 3.2.4.3.

## 3.3 Calibration of the 1-, 5-, and 10-MHz Options

The output frequency options are calibrated at the factory, and no further adjustments are required. Each output should, however, be checked to ensure that the option installation was done correctly. Either an oscilloscope, an RF voltmeter, or a frequency counter may be used to ensure that the outputs are working correctly. Because the Rubidium source is far more accurate than any common frequency counter, any minor error is attributable to the counter. Most counters should read better than $\pm$100 Hz of the specified frequency.

# SECTION 4
# OPERATION

## 4.1 INTRODUCTION

**CAUTION**

If the AS211 is rack mounted, be sure that at least 1/2-inch clearance exists above and below the unit. Do not stack other equipment directly on top of the unit if it is used as a stand-alone unit.

The AS211 is a completely self-contained unit that requires only 115-V ac prime power and/or +28-V dc power for complete Rubidium-derived output frequency distribution.

## 4.2 CONTROLS AND INDICATORS

Table 4-1 describes the controls and connectors of the AS211 and is keyed to Figures 4-1 (front panel) and 4-2 (rear panel).

Table 4-1
AS211 CONTROLS AND CONNECTORS

| INDEX NUMBER | FIGURE NUMBER | PANEL MARKING | FUNCTION |
|---|---|---|---|
| 1 | 4-1 | | MAIN POWER SWITCH |
| 2 | 4-1 | RUBIDIUM PHASE LOCK | LIGHTS WHEN THE RUBIDIUM CELL'S OUTPUT FREQUENCY IS LOCKED |
| 3 | 4-1 | FREQUENCY ADJUSTMENT | FINE FREQUENCY ADJUSTMENT FOR THE RUBIDIUM STANDARD |
| 4 | 4-1 | 10-MHz OUTPUT | LOW-LEVEL 10-MHz OUTPUT FOR RUBIDIUM MOINTORING |
| 5 | 4-2 | OUTPUT | RUBIDIUM-DERIVED FREQUENCY OUTPUT |
| 6 | 4-2 | LEVEL ADJUSTMENT | ADJUSTS THE OUTPUT VOLTAGE OF THE OUTPUT DIRECTLY ABOVE THE ADJUSTMENT CONTROL |
| 7 | 4-2 | +28-V dc REVERSED | LIGHTS IF THE POLARITY OF THE EXTERNAL +28 V dc IS REVERSED |
| 8 | 4-2 | +28-V dc INPUT | INPUT CONNECTOR FOR +28 V dc STANDBY AND/OR dc OPERATION |
| 9 | 4-2 | +28 V, 5A | FUSE FOR THE EXTERNAL +28 V dc |
| 10 | 4-2 | 115 V ac, +5/-10% | 115-V ac PRIME POWER INPUT |
| 11 | 4-2 | 2A, 5B | 115-V ac LINE FUSE |

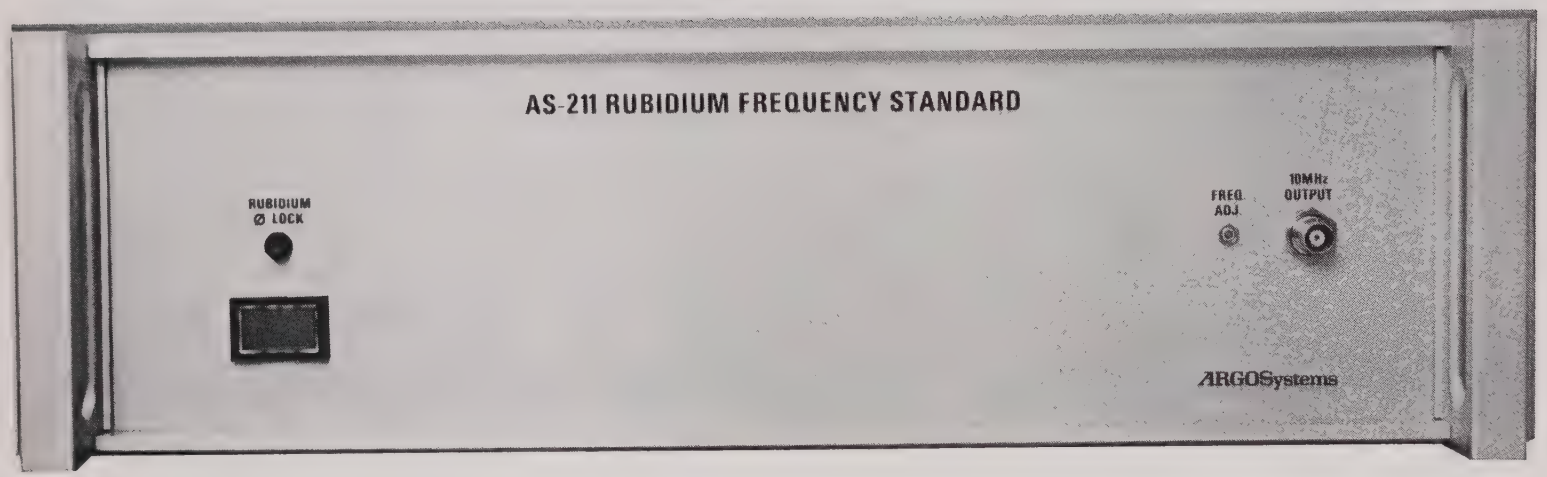


Figure 4-1 AS211 Front Panel Controls and Connectors

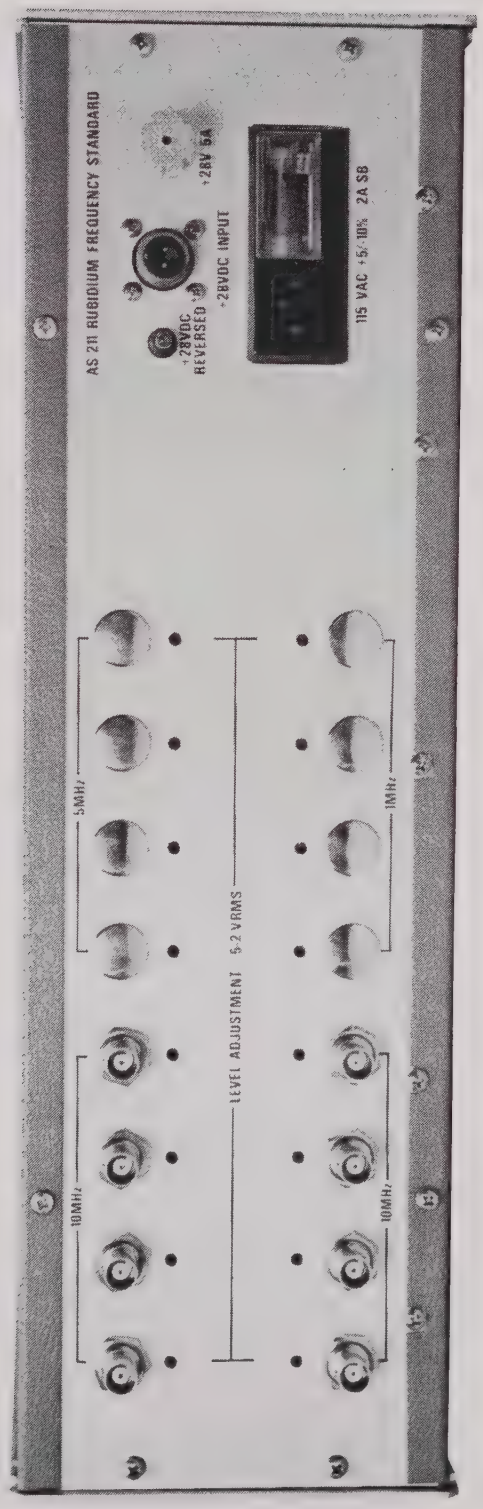


Figure 4-2 AS211 Rear Panel Controls and Connectors

# SECTION 5
# THEORY OF OPERATION

## 5.1 INTRODUCTION

This section describes the functional operation of the AS211 circuits. Figure 5-1 is a complete circuit diagram.

## 5.2 GENERAL DESCRIPTION

The AS211 includes all the necessary circuitry to perform the following options:

1. Supplies conditioned dc power from an ac input.
2. Switches to dc backup if ac input is low or fails.
3. Provides a Rubidium frequency source.
4. Isolates the outputs from the Rubidium standard frequency.
5. Divides frequency.
6. Forms sinusoidal waves.
7. Amplifies signals.
8. Provides 4, 8, 12, or 16 outputs.
9. Provides level adjustment for each output.
10. Provides an output connector for Rubidium frequency source monitoring.
11. Provides a frequency adjustment control for the Rubidium frequency source.

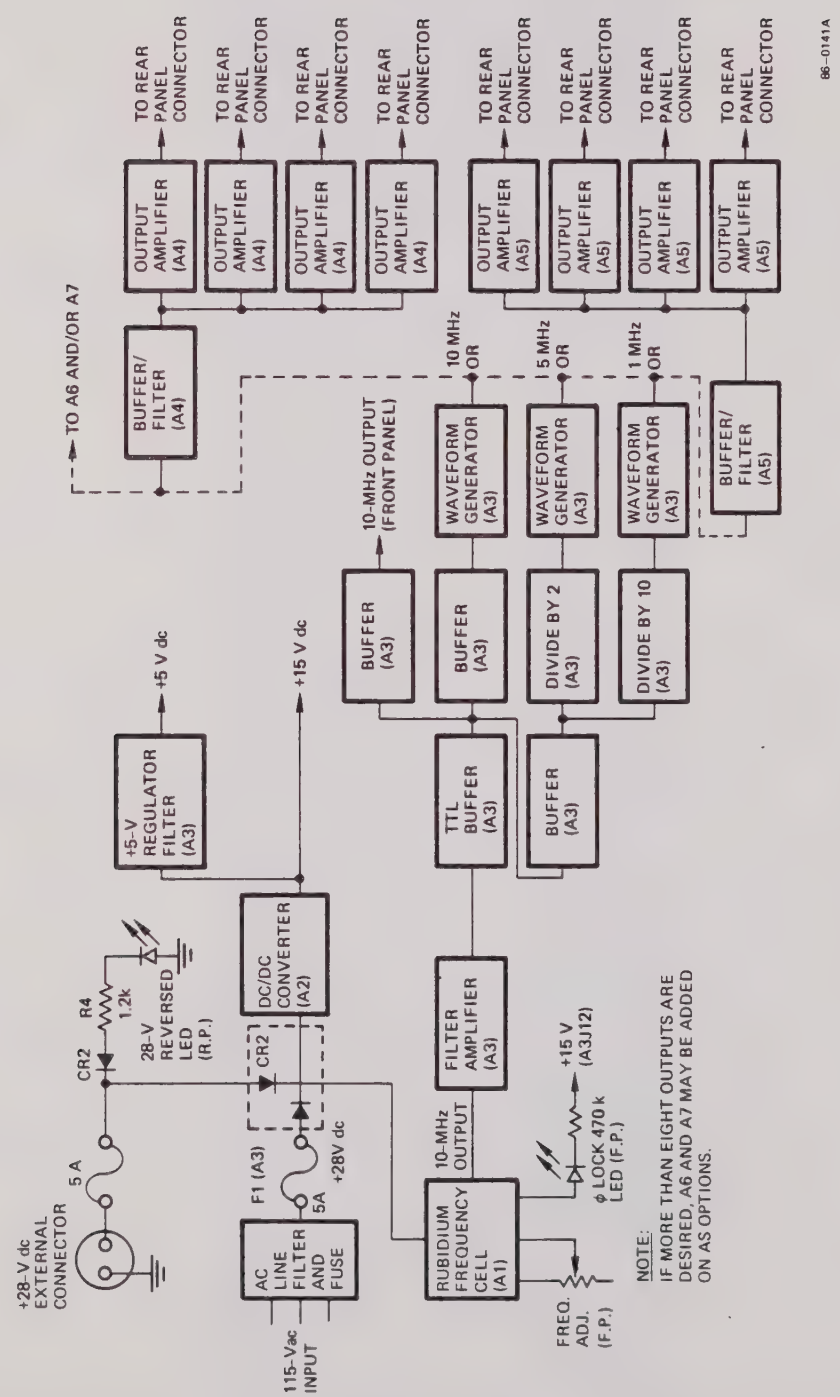


Figure 5-1 AS211 Circuit Diagram

## 5.3 POWER SUPPLIES

Prime 115-V ac power is applied to the power-line filter located on the rear panel of the AS211. The AS211 Power Transformer TI provides a single output of 24 V ac that is full wave rectified by CRI and filtered by CI and C2 to provide unregulated +28 V dc to the Rubidium cell (A1) and the +15-V dc/dc converter (A2). Two diodes in the full-wave bridge CR2 are used for switching between the +28-V dc external power source and the 115-V ac prime power. A third diode in CR2 is used for detection of reversed polarity in the external +28-V dc input. The dc/dc converter accepts the +28-V dc input and converts it to a regulated +15-V dc output. The regulated 15-V dc provides power to the buffer amplifier boards (A4 through A7) and the waveform generator board (A3), each of which further conditions the 15 V dc with capacitive filtering. The waveform generator board also contains a +5-V dc regulator, which uses the +15 V dc as an input source to serve as the V dc for the Input Amplifier Q1, Buffer U1, and Dividers U2 and U3.

## 5.4 ISOLATION

The combination of input elements at JI on the waveform generator board (A3) provides filtering and amplification (by Q1) and provides the input to Buffer UI (Pin 1). Buffer U1 provides a TTL output in phase with the 10-MHz signal from the Rubidium standard. The signal is again buffered by U1 (Pins 3 and 5) and then sent to the first stages of the frequency division and waveforming networks. The signal is also buffered by U1 (Pin 9) and sent from J2 to the front panel 10-MHz-monitoring output connector.

## 5.5 FREQUENCY DIVISION

The output of U1 (Pin 6 on A3) is sent to U2 and U3. U2 divides the input signal by two to provide a 5-MHz TTL signal output. U3 divides the 10 MHz by two to provide an output TTL signal of 1 MHz.

## 5.6 WAVEFORM SHAPING

Each of the three TTL signals (1, 5, and 10 MHz) from UI, U2, and U3, respectively, is filtered to form sinusoidal outputs at their respective frequencies. Transistor Q2 and the tuned filter circuit on its collector serves as a tuned buffer and forms a 10-MHz bandpass filter. This network filters harmonics present in the TTL input signal. The filter networks at the outputs of U2 and U3 serve as lowpass filters for the 1- and 5-MHz circuits and provide necessary waveform shaping of the respective TTL signals.

## 5.7 SIGNAL AMPLIFICATION

After waveform shaping, the 1- and 5-MHz signals are amplified by transistor pairs Q3-Q4 and Q5-Q6, respectively. The output of each transistor pair has an impedance-matching transformer (T1 and T2), and all three output frequencies (10, 5, and 1 MHz) include a dc-blocking capacitor (C6, C12, and C18, respectively). From this point, the outputs proceed to the buffer amplifier board(s) (A4 through A7).

Each buffer amplifier's input is isolated from its output by a buffer made up of QI and Q2. The output of this buffer contains a tuned bandpass filter made up of L1 and C4-C5. This filter is selected to pass one of the three possible output frequencies: 10, 5, or 1 MHz. Each output stage has its own two-stage amplifier to provide 1 V RMS output and sufficient current capability to drive a 50-ohm load. Each amplifier also has an output transformer to provide impedance matching and an output capacitor for dc blocking.

## 5.8 FACTORY-SELECTABLE RESISTORS

The AS211 has three factory-selectable resistors: R5, R13, and R22. They are all located on the waveform generator board (A3) and are selected to ensure an adequate output level of 1-V RMS into 50 ohms at each

buffer amplifier board's final output. R5 sets the 10-MHz level and is typically 10k ohms; R13 sets the 5-MHz level and is typically 220 ohms; and R22 sets the 1-MHz level and is typically 180 ohms.

# SECTION 6
# MAINTENANCE AND CALIBRATION

## 6.1 INTRODUCTION

This section provides guidance for AS211 maintenance and calibration/alignment procedures. Figures 6-1 through 6-5 (see the end of Section 6) are the schematics, components layout, and wiring diagram for the AS211. Contact ARGOSystems for any assistance required in maintenance or servicing.

## 6.2 PREVENTIVE MAINTENANCE

Regular maintenance of the AS211 consists solely of the usual care given to any other simple electronic device. Normal procedures require only that cleanliness be checked, that corrosion be located and removed, and that the integrity of the PC boards and connections be maintained. Once the unit is opened, perform the checks and, if necessary, the appropriate actions given in Table 6-1.

## 6.3 PERFORMANCE TESTS

Common test equipment is used to test the AS211 to ensure power-level output and frequency coherence. Both of the tests described in Sections 6.3.1 and 6.3.2 can be performed easily on an oscilloscope, using the parameters stated in these sections. No other tests are required to verify performance of the unit.

Table 6-1

AS211 PREVENTIVE MAINTENANCE CHECKS AND SERVICES

| ITEM | PROCEDURES |
|---|---|
| CABLES | Visually inspect cables for strained, cut, frayed, or other damaged insulation. |
| CLEANLINESS | Make sure the exterior surfaces of the unit are clean. of necessary, clean exterior surfaces as follows:<br>A. Using a clean soft cloth, remove the dust and loose dirt.<br>B. Using a brush, remove dust or dirt from plugs and jacks.<br>**WARNING**<br>Use only warm soapy water for cleaning all plastic parts. Many solvents will cause the plastic to become brittle. |
| CORROSION | Make sure exterior surfaces of the unit are free of rust and corrosion. |
| PRESERVATION | Inspect exterior surfaces of the unit for chipped paint or corrosion. If necessary, spot-paint surfaces as follows:<br>A. Remove rust and corrosion from metal surfaces by lightly sanding them with sandpaper.<br>B. Brush two coats of paint on base metal to protect it from further corrosion. |

6.3.1 Power Level

Any power meter in the appropriate frequency and power range can be used to test each rear panel output. The outputs may be individually adjusted to any level from 0.2- to 1.0-V RMS, ±10%, into 50 ohms. Level adjustments are located below each rear panel output connector.

### 6.3.2 Frequency

Frequency can be read out on any appropriate frequency counter. The reading should be the frequency stated on the rear panel output (1 Mhz, 5 MHz, or 10 MHz) $\pm$ the error of the counter being used. Because the frequency accuracy of the Rubidium source is far more accurate than any common counter, any minor error is attributable to the counter. Most counters should read better than $\pm$ 100 Hz of the specified frequency.

## 6.4 AS211 INTERNAL FREQUENCY STANDARD CALIBRATION

The highly accurate internal Rubidium frequency standard of the AS211 is aligned initially at the factory. Figure 6-1 shows the calibration test equipment setup. Table 6-2 lists the test equipment recommended to calibrate the Rubidium frequency standard.

To begin calibration, the Tracor 537A Frequency Difference Meter compares the test Rubidium's output frequency (10 MHz) against the output frequency (5 MHz) of a reference standard. Refer to the Tracor 537A operator's manual for specific operation procedures for this instrument. The output of the Tracor instrument is a voltage proportional to the difference in frequency between the test source and the reference source.

This voltage is put through a lowpass filter and then applied to a Hewlett-Packard HP7132A chart recorder. This instrument uses HP9280-0444 strip chart paper. The chart recorder gives a chart record of the frequency difference versus time. The HP7132A unit should be properly adjust to center the recording pen at the center of the strip chart. When the Tracor 537A unit is then selected to an accuracy of 1 part in $10^{10}$, a range of $\pm 5 \times 10^{-10}$ parts with a resolution of $1 \times 10^{-11}$ parts per minor division on the strip chart is achievable. The paper chart output of this calibrationprocess shows the difference in frequency between the frequency standard and the output

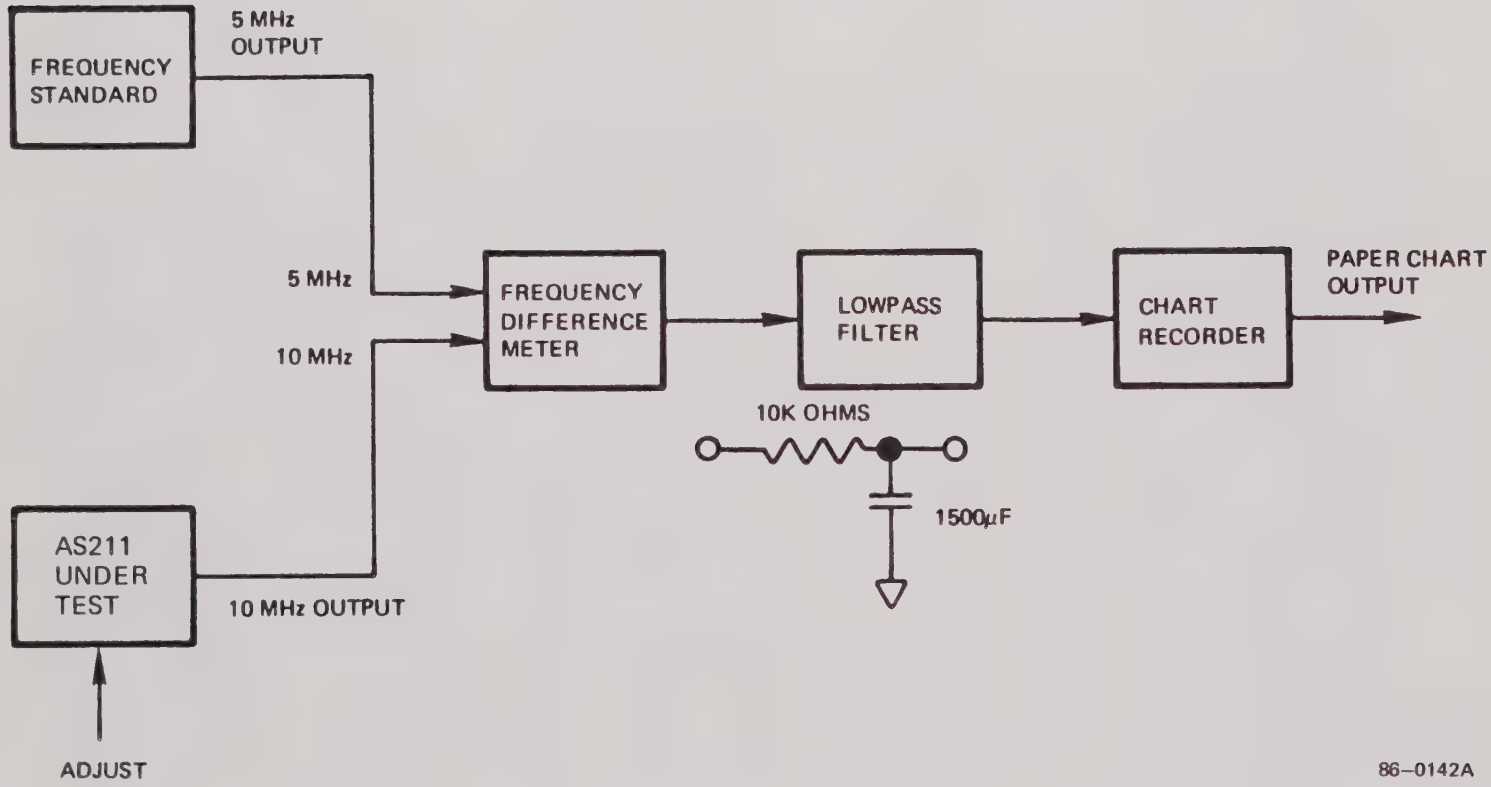


Figure 6-1 Block Diagram of Rubidium Frequency Standard Calibration Configuration

Table 6-2

TEST EQUIPMENT FOR THE AS211 INTERNAL FREQUENCY STANDARD CALIBRATION CONFIGURATION

| ITEM | RECOMMENDED TEST EQUIPMENT |
|---|---|
| FREQUENCY STANDARD | HEWLETT-PACKARD 5061A OR 5062C OPT 010 |
| FREQUENCY DIFFERENCE METER | TRACOR 537A |
| LOWPASS FILTER | 10K OHMS, 1500 µF |
| CHART RECORDER | HEWLETT-PACKARD 7132A |
| PAPER CHART REFILL | HEWLETT-PACKARD 9280-0444 |
| COAXIAL CABLE (4 REQUIRED) | 3-FT. LONG, 50 OHM, BNC |

frequency of the AS211 unit under test, as well as the frequency drift in time between the two sources. The AS211 should be warmed up sufficiently before any alignment is attempted. See Section 6.5 for the Rubidium standard's output frequency adjustment procedure.

## 6.5 AS211 INTERNAL RUBIDIUM STANDARD OUTPUT FREQUENCY ADJUSTMENT

The highly accurate internal Rubidium frequency standard may be adjusted within the range of $\pm 5$ x with a resolution of 3 x 10-11 The reference-frequency adjustment control, labeled FREQ. ADJ, is located on the rear panel. After the AS211 has sufficiently warmed up, the frequency may be changed by monitoring the output by using the test setup described in Section 6.4. Turn the FREQ. ADJ. control until the desired output is achieved.

## 6.6 RUBIDIUM FREQUENCY SOURCE FAILURE

Rubidium frequency source phase lock should be obtained within 10 minutes of power turn-on and is indicated by a logic low at Pin 5 on the Rubidium standard. Pin 6 on the Rubidium standard should have a voltage between 2.0 and 16 volts. If the Rubidium lamp is operating properly, a voltage between 5 and 12 volts will be present at Pin 7 on the Rubidium standard. An inoperative lamp is indicated by a signal of approximately 3 volts at Pin 7. Return defective Rubidium standards to ARGOSystems.

## 6.7 POWER SUPPLY FAILURE

Of a power failure occurs in any one of the three supplies, check the fuses located on the rear panel and on the waveform generator board (A3). See Table 6-3 for information on fuse replacement. All fuses are SLO-BLO. If the same problem arises after replacing the fuse(s), check the load on the failed supply for shorts.

Table 6-3
POWER SUPPLY FUSES

| CIRCUIT | FUSE LOCATION | AMPERAGE |
|---|---|---|
| ac INPUT | ON REAR PANEL IN ac FILTER ASSEMBLY | 2 |
| EXTERNAL +28-V dc INPUT | ON REAR PANEL | 5 |
| +28-V dc RECTIFIED VOLTAGE | INSIDE CHASSIS, ON BOARD A3 | 5 |

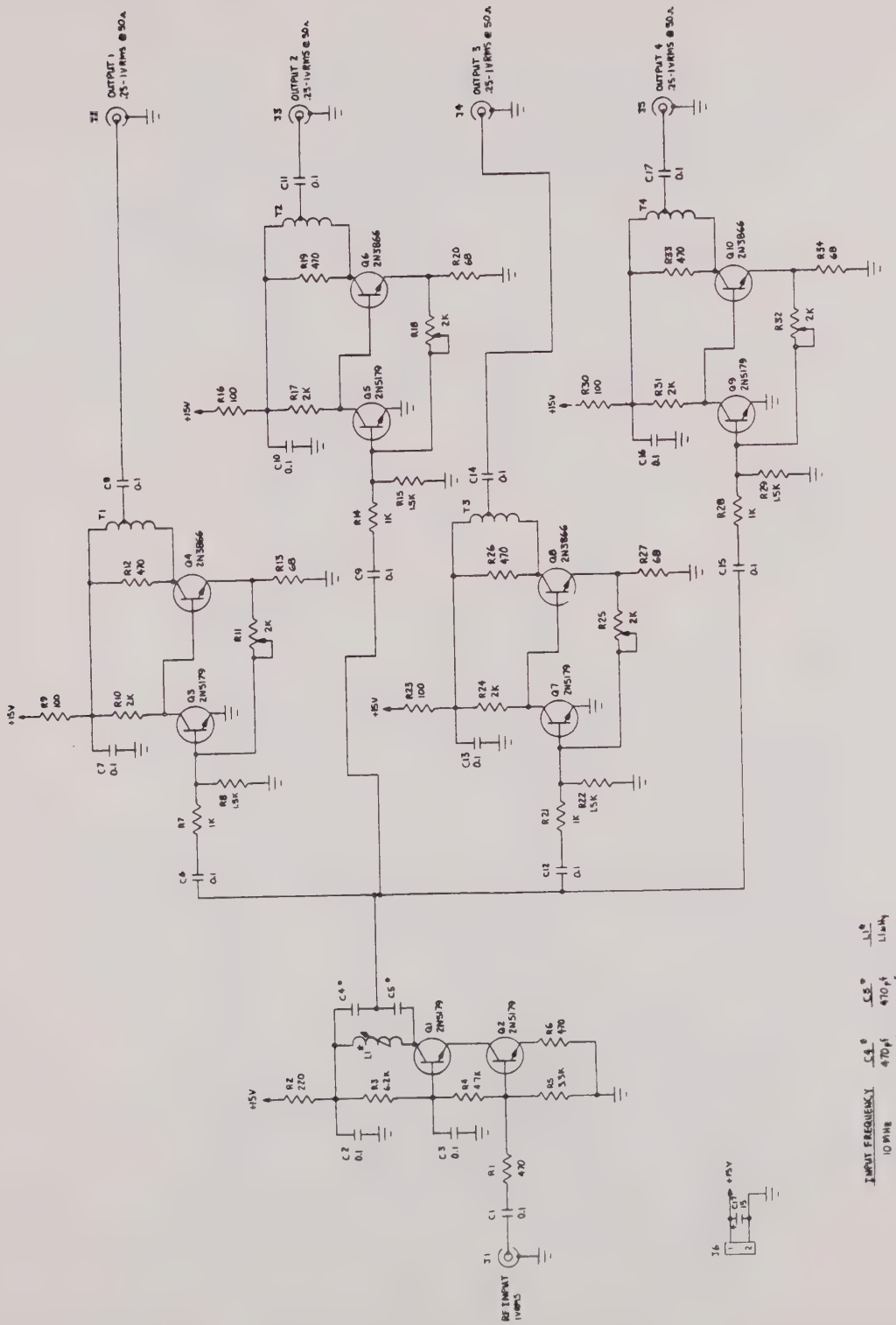


Figure 6-2 AS211 Buffer Amplifier Board Schematic Diagram

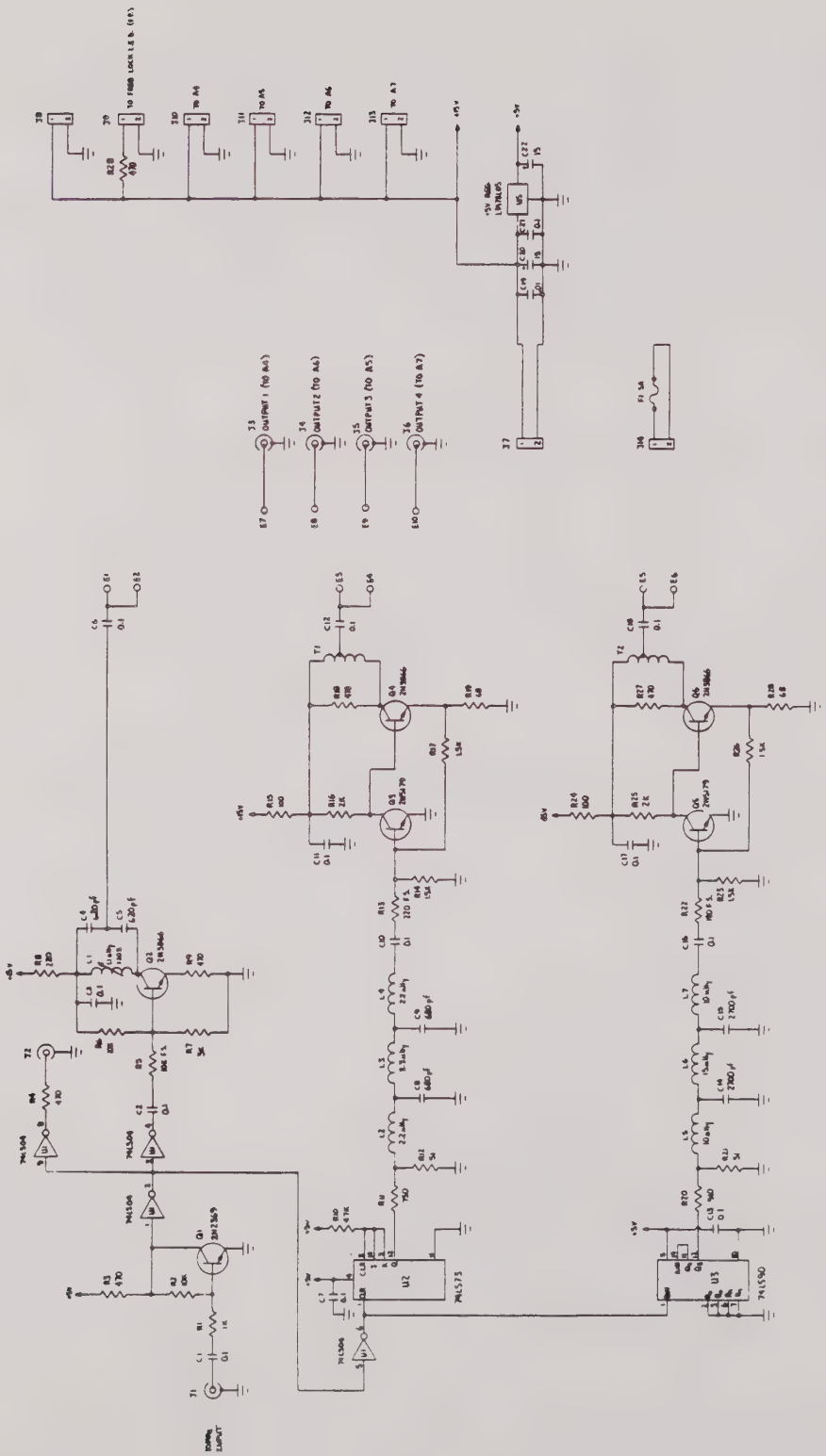

Figure 6-3 AS211 Waveform Generator Board Schematic Diagram

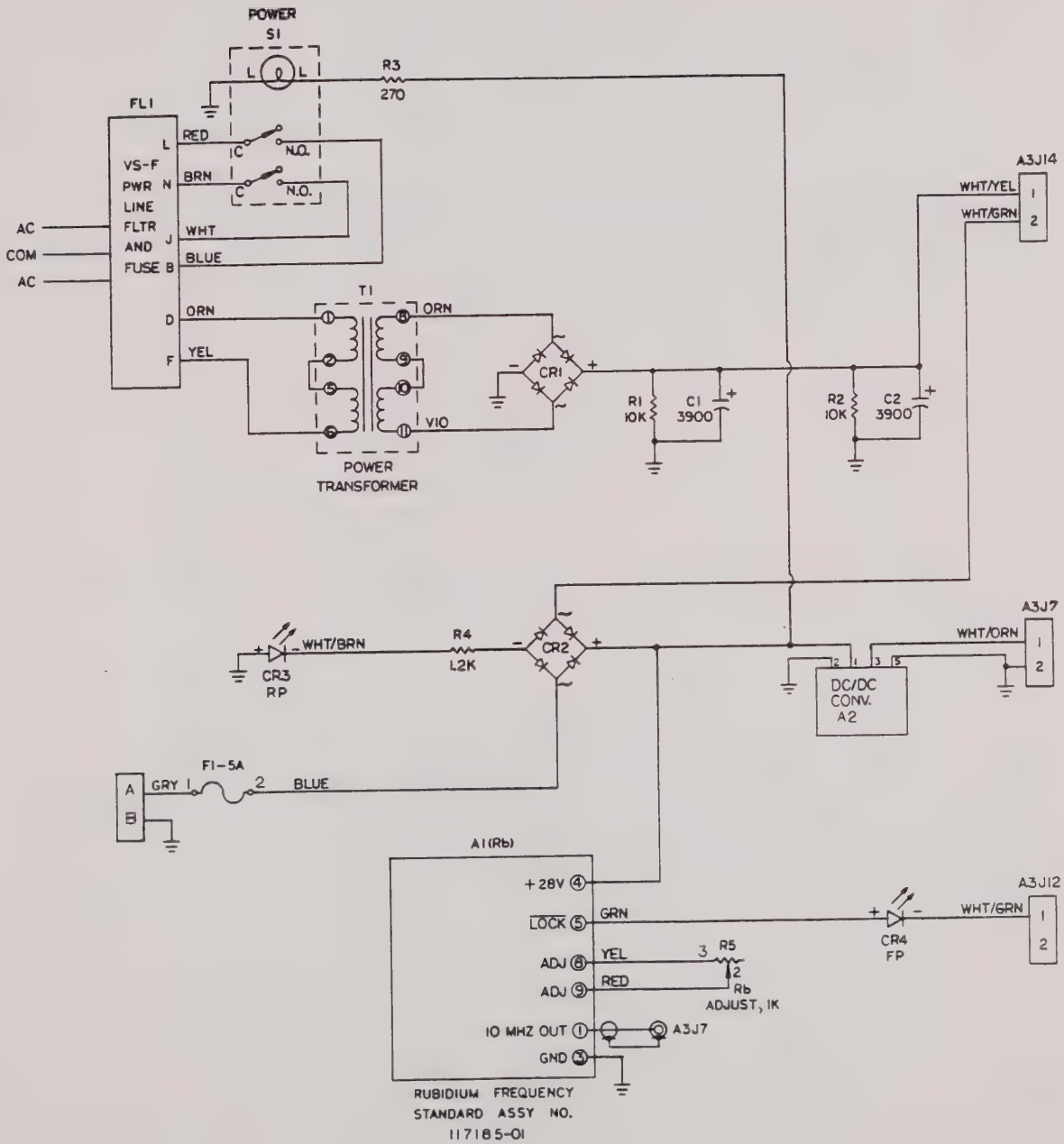


Figure 6-4 AS211 Wiring Diagram

# SECTION 7
# ILLUSTRATED PARTS LIST

## 7.1 INTRODUCTION

This section contains an illustrated parts list for the AS211. The assembly number and assembly title are listed at the top of each parts list. The parts lists are divided into six columns and arranged in the following order:

Column 1 - Item Number
Column 2 - Quantity per Assembly
Column 3 - Manufacturer's Code
Column 4 - Part Number
Column 5 - Description
Column 6 - Reference Designation

## 7.2 PARTS LISTS

Table 7-1 gives the beginning page number for each parts list. The lists are arranged by ascending parts list number, beginning with the top assembly. Figure 7-1 illustrates and immediately follows Parts Lists 152078-01, -02, -03. Figure 7-2 illustrates and immediately follows Parts List 152100.

Table 7-1

PARTS LISTS LOCATION


| PARTS LIST NUMBER | ASSEMBLY NOMENCLATURE | PAGE |
|---|---|---|
| 152070 | AS211 Rubidium Frequency Standard | 7-3 |
| 152072 | AS211 Chassis Assembly | 7-3 |
| 152078-01 | AS211 1-MHz Buffer Amplifier Board | 7-6 |
| 152078-02 | AS211 5-MHz Buffer Amplifier Board | 7-9 |
| 152078-03 | AS211 10-MHz Buffer Amplifier Board | 7-11 |
| 152085-01 | AS211 RF Cable Assembly | 7-13 |
| 152085-02 | AS211 RF Cable Assembly | 7-14 |
| 152088 | AS211 Accessory Kit | 7-15 |
| 152090 | AS211 Cable Assembly | 7-16 |
| 152095 | AS211 Front Panel Assembly | 7-17 |
| 152100 | AS211 Waveform Generator Board (A3) | 7-18 |
| 152110 | AS211 Rear Panel Assembly | 7-22 |
| 152115 | AS211 RF Cable Assembly | 7-23 |
| 152126 | AS211 Mounting Bracket Assembly Buffer Amplifier Board | 7-24 |
| 152133 | AS211 1-MHz Option | 7-25 |
| 152134 | AS211 5-MHz Option | 7-26 |
| 152135 | AS211 10-MHz Option | 7-27 |

PARTS LIST NUMBER 152070 - AS211 RUBIDIUM FREQUENCY STANDARD

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | 1 | 33472 | 152088 | Accessory Kit | |
| 4 | 1 | 33472 | 152072 | Chassis Assembly | |
| 6 | - | 33472 | 152133 | 1-MHz Option | |
| 8 | - | 33472 | 152134 | 5-MHz Option | |
| 10 | - | 33472 | 152135 | 10-MHz Option | |

PARTS LIST NUMBER 152072 - AS211 CHASSIS ASSEMBLY

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | REF | 33472 | 152076 | Wiring Diagram | |
| 4 | REF | 33472 | 152077 | Wire List | |
| 6 | 1 | 21604 | DII52-4-1QRM | Blue Instrument Case | |
| 8 | 1 | 33472 | 152107 | Left-Side Panel | Altered Item |
| 10 | 1 | 33472 | 152108 | Right-Side Panel | Altered Item |
| 12 | 1 | 33472 | 152109 | Top Bracket | Altered Item |
| 14 | 1 | 21604 | MPV-40464-13 | Top Panel | Altered Item |
| 16 | 1 | 21604 | MPV-40465-13 | Bottom Panel | Altered Item |
| 18 | 1 | 33472 | 152095 | Front Panel Assembly | |
| 20 | 1 | 33472 | 152110 | Rear Panel Assembly | |
| 22 | 1 | 33472 | 152105 | Mounting Base Plate | |
| 24 | 1 | 33472 | 152126 | Buffer Amplifier Mounting Bracket Assembly | |
| 26 | 1 | 33472 | 152100 | Waveform Generator PWA | |
| 28 | 1 | 33472 | 117310 | Rubidium Assembly | |
| 30 | 1 | - | RT-202 | Power Transformer | |
| 32 | 2 | 90201 | CGR392U 40R3C3P | 3900-µf 40-V dc Filter Capacitor | |
| 34 | 2 | 90201 | VR3 | Capacitor Mounting Clamp | |
| 36 | 2 | 33900 | SCBA-2 | Bridge Rectifier | |
| 38 | 4 | 83330 | 2104-440A0 | 4-40 Standoff | For A3 PWA |
| 40 | 8 | 96906 | M2.6 | 6-mm Length (0.236) $90^{o}$ Flat Head Metric Screw | |
| 42 | 1 | 96906 | MS51957-34 | 6-32 x 1-in. PH Screw | |

PARTS LIST NUMBER 152072 - AS211 CHASSIS ASSEMBLY (Continued)

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF.DESIG. |
|---|---|---|---|---|---|
| 44 | 1 | 96906 | MS51957-32 | 6-32 x 3/4-in. PH Screw | |
| 46 | 5 | 96906 | MS51957-29 Screw | 6-32 x 7/16-in. PH | |
| 48 | 21 | 96906 | MS51957-28 Screw | 6-32 x 3/8-in. PH | |
| 50 | 18 | 96906 | MS51957-27 Screw | 6-32 x 5/16-in. PH | |
| 52 | 41 | 96906 | MS35338-136 | #6 Split Lock Washer | |
| 54 | 41 | 80205 | NAS620-C6 | #6 Reduced O/D Flat | |
| 56 | 2 | 80205 | NAS620-CIO | #10 Flat Washer | (Used as spacer) |
| 58 | 1 | 21604 | MPV-40464-13 | Blue Full-Vented Top Panel | |
| 60 | 1 | 21604 | MPV-40465-13 | Blue Full-Vented Bottom Panel | |
| 62 | 8 | 83330 | 9153 | 4-40 x 0.625-in. Standoff | |
| 64 | 12 | 96906 | MS51957-15 | 4-40 x 3/8-in. PH Screw | |
| 66 | 1 | - | UMC13-100-24 | dc-to-dc Converter | |

PARTS LIST NUMBER 152078-01 - AS211 1-MHz BUFFER AMPLIFIER BOARD

| ITEM | QTY | CODE | MANUFACTURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | 1 | 33472 | 152083 | PWB | |
| 4 | REF | 33472 | 152081 | Schematic | |
| 6 | REF | 33472 | 152078 | Assembly Drawing | |
| 8 | 14 | 81349 | CKO5BX104K | 0.01 µF Ceramic Capacitor | C1-C3, C6-C17 |
| 10 | 1 | 81349 | CKO5BX272K | 0.0027 µF Ceramic Capacitor | C4 |
| 12 | 1 | 81349 | CKO5BX272K | 0.0027 µF Ceramic Capacitor | C5 |
| 14 | | 56289 | 196D156X9020KAI | 15-µF Tantalum Capacitor | C8 |
| 16 | 5 | 98291 | 51-051-0000 | Conhex Snap-On Connector | JI-J5 |
| 18 | 1 | 27264 | 22-03-2021 | Power Connector | J6 |
| 20 | 6 | 81349 | 2N5179 | NPN Transistor | Q1-Q3, Q5, Q7, Q9 |
| 22 | 4 | 81349 | 2N3866 | NPN Transistor | Q4, Q6, Q8, Q10 |
| 24 | 6 | 81349 | RCRO7G471JS | 470-ohm 1/4-W 5% Resistor | R1, R6, R12, R19, R26, R33 |
| 26 | 1 | 81349 | RCRO7G221JS | 220-ohm 1/4-W 5% Resistor | R2 |
| 28 | 1 | 81349 | RCRO7G622JS | 6.2k-ohm 1/4-W 5% Resistor | R3 |
| 30 | 1 | 81349 | RCRO7G472JS | 4.7k-ohm 1/4-W 5% Resistor | R4 |
| 32 | 1 | 81349 | RCRO7G332JS | 3.3k-ohm 1/4-W 5% Resistor | R5 |

PARTS LIST NUMBER 152078-01 - AS211 1-MHz BUFFER AMPLIFIER BOARD (Continued)

| ITEM | QTY | CODE | MANUFACTURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 34 | 4 | 81349 | RCR07G102JS | 1k-ohm 1/4-W 5% Resistor R28 | R7, R14, R21, |
| 36 | 4 | 81349 | RCR07G152JS | 1.5k-ohm 1/4-W 5% Resistor | R8, R15, R22, R29 |
| 38 | 4 | 81349 | RCR07GI01JS | 100-ohm 1/4-W 5% Resistor | R9, R16, R23, R30 |
| 40 | 4 | 81349 | RCR07G202JS | 2k-ohm 1/4-W 5% Resistor R31 | R10, R17, R24, |
| 42 | 4 | 01121 | 94P202 | 2k-ohm Variable Resistor | R11, R18, R25, R32 |
| 44 | 4 | 81349 | RCR07G680JS | 68-ohm 1/4-W 5% Resistor R34 | R13, R20, R27, |
| 46 | 4 | 33472 | 125598 | Transformer | TI-T4 |
| 48 | 1 | 00213 | VIV-15.0 | 15-aH Variable Coil | L1 |

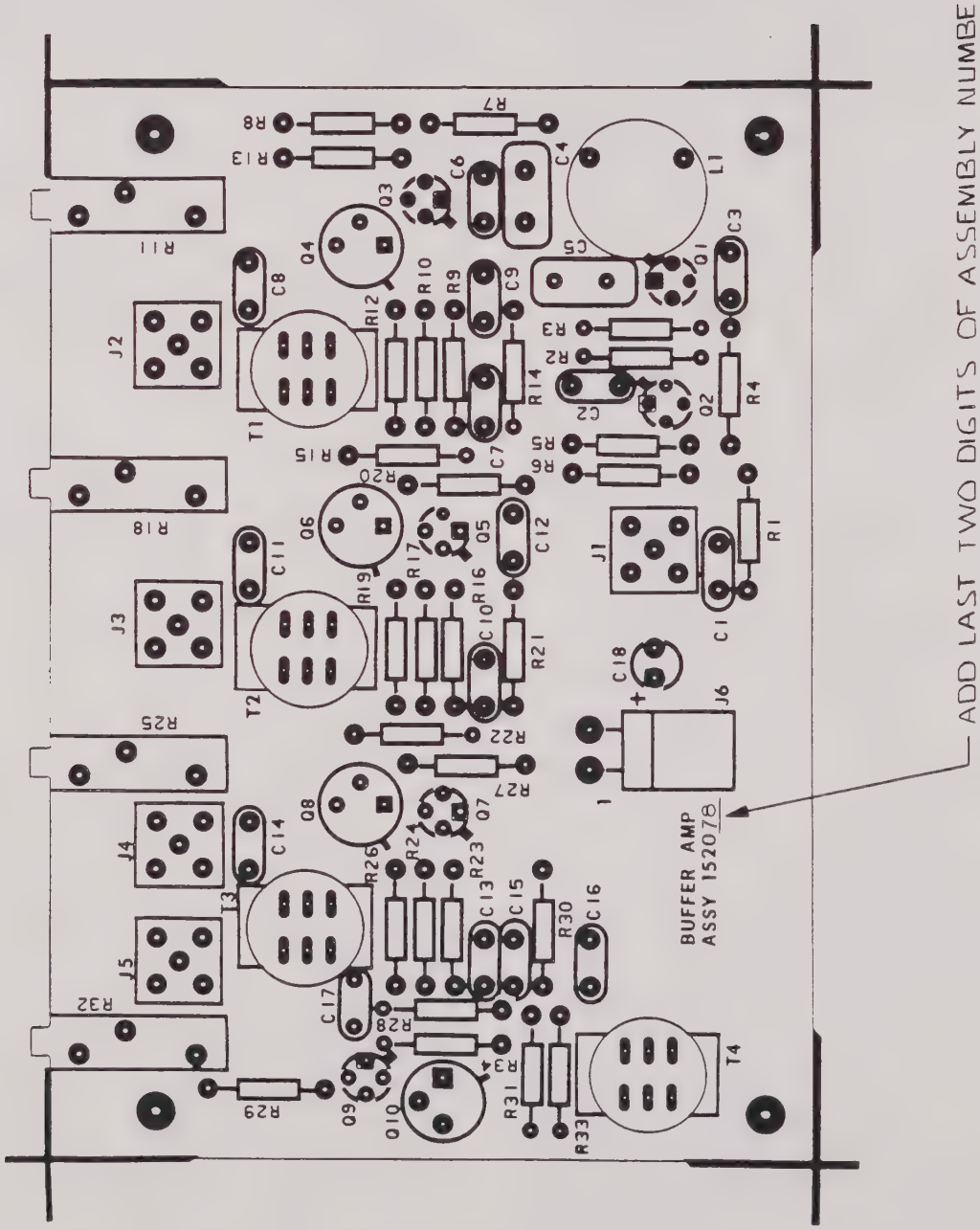


Figure 7-1 Buffer Amp Assembly 152078-01, -02, -03

PARTS LIST NUMBER 152078-02 - AS211 5-MHz BUFFER AMPLIFIER BOARD

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | 1 | 33472 | 152083PWB | | |
| 4 | REF | 33472 | 152081 | Schematic | |
| 6 | REF | 33472 | 152079 | Assembly Drawing | |
| 8 | 14 | 81349 | CKO5BXI04K | 0.1-µF Ceramic Capacitor | C1-C3, C6-C17 |
| 10 | 2 | 95146 | CMO6FD152GO3 | 1500-pF Ceramic Capacitor | C-4, C5 |
| 12 | 1 | 56289 | 196D156X9020KAI | 15-µF Tantalum Capacitor | C-18 |
| 14 | 5 | 98291 | 51-051-0000 | Conhex Snap-On Connector | J1-J5 |
| 16 | 1 | 27264 | 22-03-2021 | Power Connector | J6 |
| 18 | 6 | 81349 | 2N5179 | NPN Transistor | QI-Q3, Q5, Q7, Q9 |
| 20 | 4 | 81349 | 2N3866 | NPN Transistor | Q4, Q6, Q8, Q10 |
| 22 | 6 | 81349 | RCRO7G471JS | 470-ohm 1/4-W 5% Resistor | R1, R6, R12, R19, R26, R33 |
| 24 | 1 | 81349 | RCRO7G221JS | 220-ohm 1/4-W 5% Resistor | R2 |
| 26 | 1 | 81349 | RCRO7G622JS | 6.2k-ohm 1/4-W 5% Resistor | R3 |
| 28 | 1 | 81349 | RCRO7G472JS | 4.7k-ohm 1/4-W 5% Resistor | R4 |
| 30 | 1 | 81349 | RCRO7G332JS | 3.3k-ohm 1/4-W 5% Resistor | R5 |

PARTS LIST NUMBER 152078-02 - AS211 5-MHz BUFFER AMPLIFIER BOARD (Continued)

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 32 | 4 | 81349 | RCR07G102JS | 1k-ohm 1/4-W 5% Resistor | R7, R14, R21, R28 |
| 34 | 4 | 81349 | RCR07G152JS | 1.5k-ohm 1/4-W 5% Resistor | R8, R15 R22, R29 |
| 36 | 4 | 81349 | RCR07G101JS | 100-ohm 1/4-W 5% Resistor | R9, R16, R30 |
| 38 | 4 | 81349 | RCR07G202JS | 2k-ohm 1/4-W 5% Resistor | R10, R17, R24, R31 |
| 40 | 4 | 01121 | 94P202 | 2k-ohm Variable Resistor | R11, R18, R25, R32 |
| 42 | 4 | 81349 | RCR07G680JS | 68-ohm 1/4-W 5% Resistor | R13, R20, R27, R34 |
| 44 | 4 | 33472 | 125598 | Transformer | |
| 46 | 1 | 59705 | SK202-1 | 1.1-μH Variable Coil | L1 |

PARTS LIST NUMBER 152078-02 - AS211 5-MHz BUFFER AMPLIFIER BOARD

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | 1 | 33472 | 152083 | PWB | |
| 4 | REF | 33472 | 152081 | Schematic | |
| 6 | REF | 33472 | 152080 | Assembly Drawing | |
| 7 | 4 | | 300-50-601-105M | 1-µF Ceramic Capacitor | C7, 13, 16, 10 |
| 8 | 6 | 81349 | CK05BX104K | 0.1-µF Ceramic Capacitor | C1, 2, 3, 9, 12, 15 |
| 10 | 2 | 95146 | DM15FD471J | 470-pF MICA Capacitor | C-4, C5 |
| 12 | 1 | 56289 | 196D156X9020KAI | 15-µF Tantalum Capacitor | C-18 |
| 14 | 5 | 98291 | 51-051-0000 | Conhex Snap-On Connector | J1-J5 |
| 16 | 1 | 27264 | 22-03-2021 | Power Connector | J6 |
| 18 | 6 | 81349 | 2N5179 | NPN Transistor | Q1-Q3, Q5, Q7, Q9 |
| 20 | 4 | 81349 | 2N3866 | NPN Transistor | Q4, Q6, Q8, Q10 |
| 22 | 6 | 81349 | RCR07G471JS | 470-ohm 1/4-W 5% Resistor | R1, R6, R12, R19, R26, R33 |
| 24 | 1 | 81349 | RCR07G221JS | 220-ohm 1/4-W 5% Resistor | R2 |
| 26 | 1 | 81349 | RCR07G622JS | 6.2k-ohm 1/4-W 5% Resistor | R3 |
| 28 | 1 | 81349 | RCR07G472JS | 4.7k-ohm 1/4-W 5% Resistor | R4 |
| 30 | 1 | 81349 | RCR07G332JS | 3.3k-ohm 1/4-W 5% Resistor | R5 |

PARTS LIST NUMBER 152078-03 - AS211 10-MHz BUFFER AMPLIFIER BOARD (Continued)

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 32 | 4 | 81349 | RCR07G102JS | 1k-ohm 1/4-W 5% Resistor | R7, R14, R21, R28 |
| 34 | 4 | 81349 | RCR07G152JS | 1.5k-ohm 1/4-W 5% Resistor | R8, R15 R22, R29 |
| 36 | 4 | 81349 | RCR07G101JS | 100-ohm 1/4-W 5% Resistor | R9, R16, R23, R30 |
| 38 | 4 | 81349 | RCR07G202JS | 2k-ohm 1/4-W 5% Resistor | R10, R17, R24, R31 |
| 40 | 4 | 01121 | 94P202 | 2k-ohm Variable Resistor | R11, R18, R25, R32 |
| 42 | 4 | 81349 | RCR07G680JS | 68-ohm 1/4-W 5% Resistor | R13, R20, R27, R34 |
| 44 | 4 | 33472 | 125598 | Transformer | |
| 46 | 1 | 59705 | SK202-1 | 1.1-µH Variable Coil | L1 |

PARTS LIST NUMBER 152085-01 - AS211 RF CABLE ASSEMBLY

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | REF | 33472 | 152085 | Assembly Drawing | |
| 4 | 1 | 02660 | 86350 | BNC Bulkhead Connector | |
| 6 | 1 | 98291 | 51-051-0000 | Conhex Snap-On RF Connector | |
| 8 | A/R | 81349 | RG316/U | 50-ohm Coaxial Cable | |

PARTS LIST NUMBER 152085-02 - AS211 RF CABLE ASSEMBLY

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | REF | 33472 | 152085 | Assembly Drawing | |
| 4 | 1 | 02660 | 86350 | BNC Bulkhead Connector | |
| 6 | 1 | 98291 | 51-051-0000 | Conhex Snap-On RF Connector | |
| 8 | A/R | 81349 | RG316/U | 50-ohm Coaxial Cable | |

PARTS LIST NUMBER 152088 - AS211 ACCESSORY KIT

| ITEM | QTY | CODE | MANUFACTURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | 1 | - | 12420 | Power Cord | |
| 4 | 1 | 71486 | MS3106E105L45 | Connector with Back Shell | |
| 6 | A/R | - | 8428 | 18-AWG 2-Conductor Cable | |
| 8 | 1 | 33472 | M86-0003 | AS211 Manual | |

PARTS LIST NUMBER 152090 - AS211 CABLE ASSEMBLY

| ITEM | QTY | CODE | MANUFACTURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | REF | 33472 | 152090 | Assembly Drawing | |
| 4 | 2 | 27264 | 22-01-2021 | 2-Pin Connector | |
| 6 | 4 | 27264 | 08-50-01114 | Crimp Pins | |
| 8 | A/R | 16428 | 24 AWG | Insulated Wire | |

PARTS LIST NUMBER 152095 - AS211 FRONT PANEL ASSEMBLY

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | 1 | 33472 | 152096 | Front Panel (Fab.) | Altered Item |
| 4 | 1 | 33472 | 152085-02 | Cable Assembly | |
| 6 | 1 | 50434 | HLMP-3517 | Green LED | |
| 8 | 1 | 03797 | Q086-13D | LED Socket | |
| 10 | 1 | 32997 | 3006P-1-102Z | 1k-ohm Panel-Mount Trim Pot. | |
| 12 | 1 | 96903 | AML31LBA4AD | Power Switch | |
| 14 | 1 | 96903 | AML51-J10R | Red Transmitted-Color Lens Cap | |
| 16 | 1 | 01139 | #85 | 24-V Lamp | |

PARTS LIST NUMBER 152100 - AS211 WAVEFORM GENERATOR BOARD (A3)

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | 1 | 33472 | 152103 | PWB | |
| 4 | REF | 33472 | 152101 | Schematic | |
| 6 | REF | 33472 | 152100 | Assembly Drawing | |
| 8 | 13 | 81349 | CK05BX104K | 0.1-µF Ceramic Capacitor | C1-C3, C6, C7, C10-C13, C16-C18, C22 |
| 10 | 2 | 81349 | CM06FD621J03 | 620-pF Mica Capacitor | C4, C5 |
| 12 | 2 | 81349 | CK05BX681K | 680-pF 10% Ceramic Capacitor | C8, C9 |
| 14 | 2 | 81349 | CK05BX272K | 2700-pF 10% Ceramic Capacitor | C14, C15 |
| 16 | 1 | 51642 | 30-300-50-601-105M | 1.0-µF 20% Ceramic Capacitor | C19 |
| 18 | 1 | 81349 | CK05BX103K | 0.01-µF 10% Ceramic Capacitor | C20 |
| 20 | 2 | 56289 | 196D156X9020KAI | 15-µF 20-V 10% Tantalum Capacitor | C21, C23 |
| 22 | 6 | 98291 | 51-051-0000 | Conhex Snap-On Connector | J1-J6 |
| 24 | 7 | 27264 | 22-03-2021 | Connector | J7-J13 |
| 26 | 1 | 27264 | 09-67-1023 | Connector | J14 |
| 28 | 1 | 81349 | 2N2369 | NPN Transistor | Q1 |
| 30 | 3 | 81349 | 2N3866 | NPN Transistor | Q2, Q4, Q6 |
| 32 | 2 | 81349 | 2N5179 | NPN Transistor | Q3, Q5 |
| 34 | 1 | 81349 | RCR07G102JS | 1k-ohm 1/4-W 5% Resistor | R1 |

PARTS LIST NUMBER 152100 - AS211 WAVEFORM GENERATOR BOARD (A3)(Continued)

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 36 | 5 | 81349 | RCR07G471JS | 470-ohm 1/4-W 5% Resistor | R3, R4, R9, R19, R27 |
| 38 | 3 | 81349 | RCR07G103JS | 10k-ohm 1/4-W 5% Resistor | R2, R5, R6 |
| 40 | 1 | 81349 | RCR07G302JS | 3k-ohm 1/4-W 5% Resistor | R7 |
| 42 | 2 | 81349 | RCR07G221JS | 220-ohm 1/4-W 5% Resistor | R8 |
| 44 | 1 | 81349 | RCR07G472JS | 4.7k-ohm 1/4-W 5% Resistor | R10 |
| 46 | 1 | 81349 | RCR07G751JS | 750-ohm 1/4-W 5% Resistor | R11 |
| 48 | 2 | 81349 | RCR07G510JS | 51-ohm 1/4-W 5% Resistor | R12, R21 |
| 50 | 4 | 81349 | RCR07G152JS | 1.5k-ohm 1/4-W 5% Resistor | R14, R17, R23, R26 |
| 52 | 2 | 81349 | RCR07G101JS | 100-ohm 1/4-W 5% Resistor | R15, R24 |
| 54 | 2 | 81349 | RCR07G202JS | 2k-ohm 1/4-W 5% Resistor | R16, R25 |
| 56 | 2 | 81349 | RCR07G680JS | 68-ohm 1/4-W 5% Resistor | R19, R28 |
| 58 | 1 | 81349 | RCR07G911JS | 910-ohm 1/4-W 5% Resistor | R20 |
| 60 | 2 | 81349 | RCR07G102JS | 150-ohm 1/4-W 5% Resistor | R13, R22 |
| 62 | 2 | 33472 | 125598 | Transformer | T1, T2 |
| 64 | 1 | 01295 | 74LS04 | Hex Inverter IC | U1 |

PARTS LIST NUMBER 152100 - AS211 WAVEFORM GENERATOR BOARD (A3)(Continued)

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 66 | 1 | 01295 | 74LS73 | Dual J-K Flip-Flop IC | U2 |
| 68 | 1 | 01295 | 74LS90 | Decade Counter IC | U3 |
| 72 | 1 | 27014 | LM78L05ACZ | +5-V Regulator IC | U5 |
| 74 | 1 | 59705 | SK202-1 | 1.1-µH Variable Coil | LI |
| 76 | 2 | 96906 | MS75084-04 | 2.2-µH Inductor | L2, L4 |
| 78 | 1 | 96906 | MS75084-06 | 3.3-µH Inductor | L3 |
| 80 | 2 | 96906 | MS75084-12 | 10-µH Inductor | L5, L7 |
| 82 | 1 | 96906 | MS75084-14 | 15-µH Inductor | L6 |
| 84 | 3 | 01295 | C931402 | 14-Pin IC Socket | |

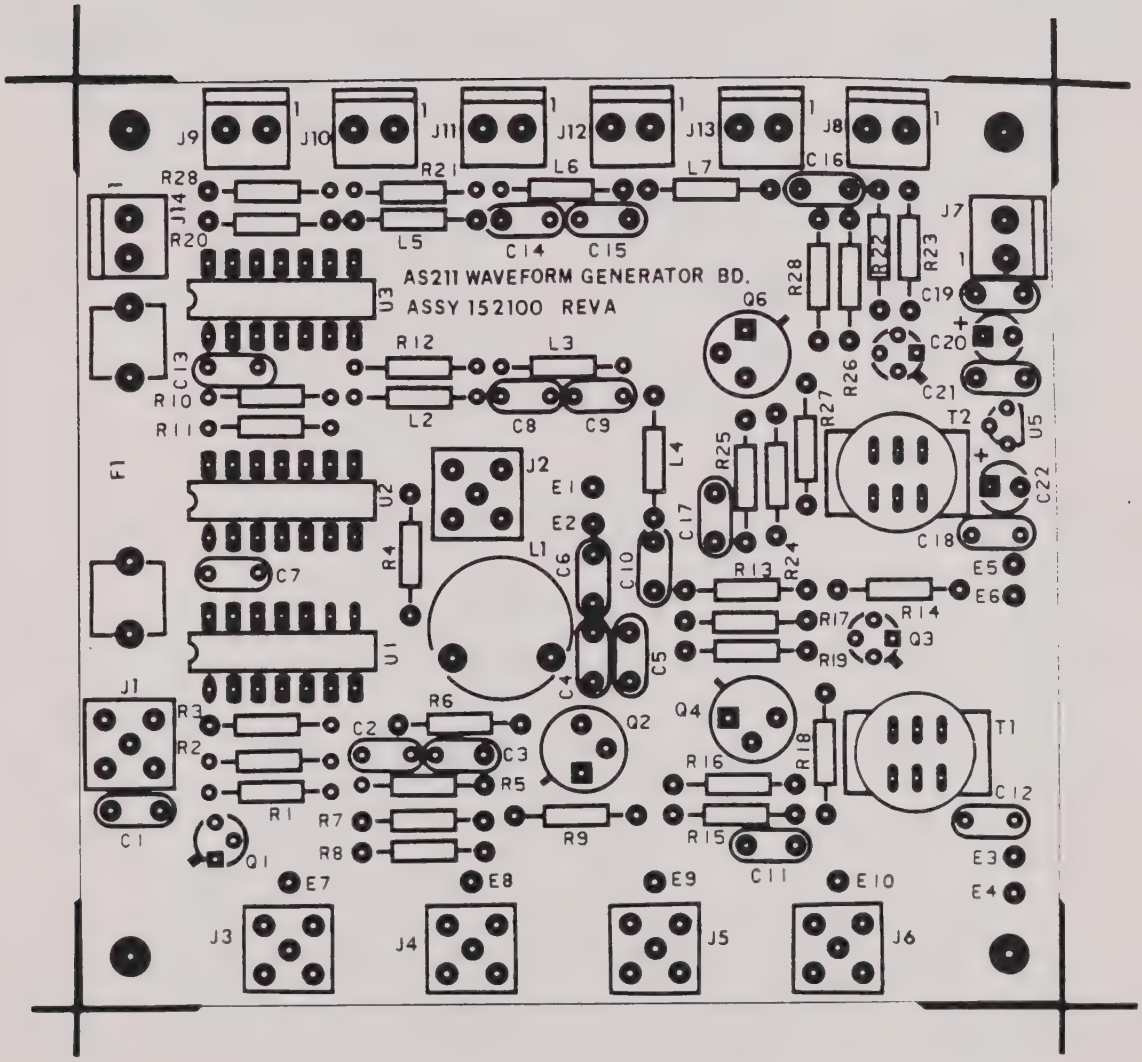


Figure 7-2 Waveform Generator Board 152100

PARTS LIST NUMBER 152110 - AS211 REAR PANEL ASSEMBLY

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | 1 | 33472 | 152111 | Rear Panel (Fab.) | Altered Item |
| 6 | 1 | 05245 | 6J4 | EMI Line Filter | |
| 8 | 1 | 50434 | HLMP-3315 | Red LED | |
| 10 | 1 | 03797 | Q086-13D | LED Socket | |
| 12 | 1 | 75915 | 342838 | Fuse Holder | |
| 14 | 1 | 71468 | MS3102E10SL-4P | Connector | |
| 16 | 1 | 75915 | 313005 | 5-Amp Slo-Blo Fuse | |
| 18 | 1 | 75915 | 313002 | 2-Amp Slo-Blo Fuse | |
| 20 | 4 | 96906 | MS51957-15 | 4-40 x 3/8-in. PH Screw | |
| 22 | 8 | 96906 | NAS620-C4 | #4 Reduced O/D Flat Washer | |
| 24 | 4 | 96906 | MS35338-135 | #4 Split Lock Washer | |

PARTS LIST NUMBER 152115 - AS211 RF CABLE ASSEMBLY

| ITEM | QTY | CODE | MANUFACTURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | REF | 33472 | 152115 | Assembly Drawing | |
| 4 | 2 | 98291 | 51-051-0000 | Conhex Snap-On RF Connector | |
| 6 | A/R | 81349 | RG316/U | 50-ohm Coaxial Cable | |

PARTS LIST NUMBER 152126 - AS211 BUFFER AMPLIFIER BOARD MOUNTING BRACKET ASSEMBLY

| ITEM | QTY | CODE | MANUFACTURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | 1 | 33472 | 152106 | Buffer Amplifier Mounting Bracket | Fab. |
| 4 | 8 | 83330 | 4505-440-A0 | 4-40 x 1/2-in. Top Standoff | |
| 6 | A/R | 33472 | 152133 | 1-MHz Buffer Amplifier | Option |
| 8 | A/R | 33472 | 152134 | 5-MHz Buffer Amplifier | Option |
| 10 | A/R | 33472 | 152135 | 10-MHz Buffer Amplifier | Option |

PARTS LIST NUMBER 152133 - AS211 1-MHz OPTION

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | REF | 33472 | 152086 | Installation Instructions | |
| 4 | 1 | 33472 | 152078 | 1-MHz PWB Assembly | |
| 6 | 4 | 33472 | 152085-01 | Cable Assembly | |
| 8 | 1 | 33472 | 152130 | 1-MHz Identification Label | |
| 10 | 4 | 81349 | MS51957-11 | 4-40 x 5/16-in. PH Screw | |
| 12 | 4 | 81349 | MS35338-135 | #4 Split Lock Washer | |
| 14 | 4 | 81349 | NAS620-C4 | #4 Reduced O/D Flat Washer | |
| 16 | 1 | 33472 | 152115 | RF Cable Assembly | |
| 18 | 1 | 33472 | 152090 | Cable Assembly | |

PARTS LIST NUMBER 152134 - AS211 5-MHz OPTION

| ITEM | QTY | CODE | MANUFACTURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | REF | 33472 | 152086 | Installation Instructions | |
| 4 | 1 | 33472 | 152079 | 5-MHz PWB Assembly | |
| 6 | 4 | 33472 | 152085-01 | Cable Assembly | |
| 8 | 1 | 33472 | 152131 | 5-MHz Identification Label | |
| 10 | 4 | 81349 | MS51957-11 | 4-40 x 5/16-in. PH Screw | |
| 12 | 4 | 81349 | MS35338-135 | #4 Split Lock Washer | |
| 14 | 4 | 83149 | NAS620-C4 | #4 Reduced O/D Flat Washer | |
| 16 | 1 | 33472 | 152115 | RF Cable Assembly | |
| 18 | 1 | 33472 | 152090 | Cable Assembly | |

PARTS LIST NUMBER 152135 - AS211 10-MHz OPTION

| ITEM | QTY | CODE | MANUFAC-TURER'S PART NUMBER | DESCRIPTION | REF. DESIG. |
|---|---|---|---|---|---|
| 2 | REF | 33472 | 152086 | Installation Instructions | |
| 4 | 1 | 33472 | 152080 | 10-MHz PWB Assembly | |
| 6 | 4 | 33472 | 152085-01 | Cable Assembly | |
| 8 | 1 | 33472 | 152132 | 10-MHz Identification Label | |
| 10 | 4 | 81349 | MS51957-11 | 4-40 x 5/16-in. PH Screw | |
| 12 | 4 | 81349 | MS35338-135 | #4 Split Lock Washer | |
| 14 | 4 | 83149 | NAS620-C4 | #4 Reduced O/D Flat Washer | |
| 16 | 1 | 33472 | 152115 | RF Cable Assembly | |
| 18 | 1 | 33472 | 152090 | Cable Assembly | |

## 7.3 MANUFACTURER'S CODE-TO-NAME LIST

This section contains all manufacturer's codes for materials used in the AS210 system. The codes are listed in ascending numerical order.

| CODE | MANUFACTURER | ADDRESS |
|---|---|---|
| 00779 | AMP, INC. | P.O. Box 3608<br>Harrisburg, PA 17105 |
| 01121 | ALLEN-BRADLEY COMPANY | 1202 South 2nd Street<br>Milwaukee, WI 53204 |
| 01139 | GENERAL ELECTRIC COMPANY | Silicone Products Business Department<br>Waterford, NY 12188<br>PHONE: 518-237-3330 |
| 01281 | TRW, INC. | TRW Semiconductor Division<br>14520 Aviation Boulevard<br>Lawndale, CA 90260 |
| 01295 | TEXAS INSTRUMENTS, INC. | Semiconductor Group<br>13500 North Central Expressway<br>P.O. Box 225012 M/S 49<br>Dallas, TX 75265 |
| 02114 | AMPEREX ELECTRONIC CORPORATION | Ferroxcub Division<br>5083 Kings Highway<br>Saugerties, NY 12477 |
| 02660 | BUNKER RAMO-ELTRA CORPORATION | Amphenol Division<br>2801 South. 25th Avenue<br>Broadview, IL 60153 |
| 02735 | RCA CORPORATION | Solid State Division<br>Route 202<br>Somerville, NJ 08876 |

| CODE | MANUFACTURER | ADDRESS |
|---|---|---|
| 03797 | GENISCO TECHNOLOGY CORPORATION | Electronics Division<br>18435 Susana Road<br>Rancho Dominguez, CA 90221<br>PHONE: 213-537-4750 |
| 04426 | ILLINOIS TOOL WORKS, INC. | Licon Division<br>6615 West Irving Park Road<br>Chicago, IL 60634 |
| 04713 | MOTOROLA, INC. | Semiconductor Products Sector<br>5005 East McDowell Road<br>Phoenix, AZ 85008<br>PHONE: 602-244-7100 |
| 05245 | CORCOM, INC. | 1600 Wincheste Road<br>Libertyville, IL 60048 |
| 06090 | RAYCHEM CORPORATION | 300 Constitution Drive<br>Menlo Park, CA 94025 |
| 06383 | PANDUIT CORPORATION | 17301 Ridgeland<br>Tinley Park, IL 60477 |
| 06540 | MITE CORPORATION | Amatom Electronic Hardware Division<br>446 Blake Street<br>New Haven, CT 06515 |
| 07263 | FAIRCHILD CAMERA AND INSTRUMENT CORPORATION | Sub of Schlumberger LTD<br>North American Sales<br>Mail Stop 14-1053<br>401 Ellis Street<br>P.O. Drawer 7284<br>Mt. View, CA 94042 |
| 09353 | C AND K COMPONENTS, INC. | 15 Riverdale Avenue<br>Newton, MA 02158<br>PHONE: 617-964-6400 |

| CODE | MANUFACTURER | ADDRESS |
|---|---|---|
| 11237 | CTS KEENE, INC. | P.O. Box 1977<br>Paso Robles, CA 93446 |
| 12136 | PHC INDUSTRIES, INC. | 1643 Haddon Avenue<br>Camden, NJ 08103 |
| 13103 | THERMALLOY COMPANY, INC. | 2021 West Valley View Lane<br>P.O. Box 340839<br>Dallas, TX 75234 |
| 13556 | TRW CINCH CONNECTORS | Nuline Facility<br>Division of TRW, Inc.<br>New Hope, MN |
| 14099 | SEMTECH CORPORATION | 652 Mitchell Road<br>Newbury Park, CA 91320<br>PHONE: 213-628-5392 |
| 14655 | CORNELL-DUBILIER ELECTRONICS | Div. of Federal Pacific Electric Co.<br>Government Contracts Department<br>150 Avenue L<br>Newark, NJ 07101 |
| 15542 | MINI-CIRCUITS LABORATORY | Div. of Scientific Components Corp.<br>2625 East 14th Street<br>Brooklyn, NY 11235 |
| 16428 | BELDEN ELECTRONIC WIRE AND CABLE | Sub of Cooper Industries, Inc.<br>2200 U.S. Highway 27 South<br>P.O. Box 1980<br>Richmond, IN 47374<br>PHONE: 317-983-5200 |
| 18612 | VISHAY INTERTECHNOLOGY, INC. | Vishay Resistor Products Division<br>63 Lincoln Highway<br>Malvern, PA 19355 |

| CODE | MANUFACTURER | ADDRESS |
|---|---|---|
| 19209 | GENERAL ELECTRIC COMPANY | Battery Business Department<br>441 Highway N<br>P.O. Box 861<br>Gainesville, FL 32602<br>PHONE: 904-462-3911 |
| 23936 | PAMOTOR DIVISION OF<br>WILLIAM J. PURDY COMPANY | 770 Airport Boulevard<br>Burlingame, CA 94010 |
| 26805 | OMNI SPECTRA, INC. | Microwave Connector Division<br>Waltham, MA |
| 26806 | AMERICAN ZETTLER, INC. | 16881 Hale Avenue<br>Irvine, CA 92714 |
| 27014 | NATIONAL SEMICONDUCTOR<br>CORPORATION | 2900 Semiconductor Drive<br>Santa Clara, CA 95051 |
| 27264 | MOLEX, INC. | 2222 Wellington Court<br>Lisle, IL 60532 |
| 32997 | BOURNS, INC. | Trimpot Division<br>1200 Columbia Avenue<br>Riverside, CA |
| 33472 | ARGOSYSTEMS, INC. | 310 N. Mary Avenue<br>Sunnyvale, CA 94086 |
| 34649 | INTEL CORPORATION | 3585 SW 198th Avenue<br>Aloha, OR 97005 |
| 50088 | MOSTEK CORPORATION | Sub. of United Technologies Corp.<br>1215 West Crosby Road<br>P.O. Box 169<br>Carrollton, TX 75006 |

| CODE | MANUFACTURER | ADDRESS |
|---|---|---|
| 50434 | HEWLETT-PACKARD COMPANY | Optoelectronics Division<br>640 Page Mill Road<br>Palo Alto, CA 94304 |
| 51642 | CENTRE ENGINEERING, INC. | 2820 E. College Avenue<br>State College, PA 16801 |
| 53387 | MINNESOTA MINING AND MANUFACTURING COMPANY | Electronic Products Division<br>3M Center<br>St. Paul, MN 55101 |
| 54893 | HEWLETT-PACKARD COMPANY | Microwave Semiconductor Division<br>350 West Trimble Road<br>San Jose, CA 95131 |
| 55154 | PLESSEY PERIPHERAL SYSTEMS, INC. | 17466 Daimler Avenue<br>P.O. Box 19616<br>Irvine, CA 92714 |
| 55566 | R A F ELECTRONIC HARDWARE, INC. | Seymour, CT 06483<br>PHONE: 203-888-2133 |
| 56289 | SPRAGUE ELECTRIC COMPANY | 87 Marshall Street<br>North Adams, MA 01247 |
| 58910 | ABBOTT TRANSISTOR LABORATORIES, INC. | Transformer Division<br>639 South Glenwood Place<br>Burbank, CA 91506 |
| 59660 | TUSONIX, INC. | 2155 North Forbes Boulevard<br>Suite 107<br>Tucson, AZ 85745 |
| 59705 | STANDEX INTERNATIONAL CORPORATION | United Service Equipment Co. Div.<br>1152 Park Avenue<br>Murfreesboro, TN 37130 |

| CODE | MANUFACTURER | ADDRESS |
|---|---|---|
| 71279 | MIDLAND-ROSS CORPORATION | Cambion Division<br>One Alewife Place<br>Cambridge, MA 02140<br>PHONE: 617-491-5400 |
| 71450 | CTS CORPORATION | 905 North West Boulevard<br>Elkhart, IN 46514 |
| 71984 | DOW CORNING CORPORATION | 3901 South Saginaw Road<br>Midland, MI 48640 |
| 73138 | BECKMAN INSTRUMENTS, INC. | Helipot Division<br>Sub of Smith Kline/Beckman Corp.<br>2500 Harbor Boulevard<br>Fullerton, CA 92634 |
| 75915 | TRACOR LITTLEFUSE, INC. | 800 East Northwest Highway<br>Des Plaines, IL 60016 |
| 77969 | RUBBERCRAFT CORPORATION OF CALIFORNIA LTD. | 1800 West 220th Street<br>P.O. Box B<br>Torrance, CA 90507<br>PHONE: 213-328-5402 |
| 78277 | SIGMA INSTRUMENTS, INC. | 170 Pearl Street<br>South Braintree, MA 02184<br>PHONE: 617-853-5000 |
| 80009 | TEKTRONIX, INC. | 4900 Southwest Griffith Drive<br>P.O. Box 500<br>Beaverton, OR 97077 |
| 81349 | MILITARY SPECIFICATIONS | Promulgated by Military Departments/Agencies Under Authority of Defense Standardization Manual 4120 3-M |

| CODE | MANUFACTURER | ADDRESS |
|---|---|---|
| 83330 | SMITH HERMAN H., INC. | A North American Philips Company<br>1913 Atlantic Avenue<br>Manasquan, NJ 08736 |
| 88245 | WINCHESTER ELECTRONICS | Litton Systems-Useco Division<br>1536 Saticoy Street<br>Van Nuys, CA 91409 |
| 90201 | MALLORY CAPACITOR COMPANY | Sub of Emhart Industries, Inc.<br>4760 Kentucky Avenue<br>P.O. Box 372<br>Indianapolis, IN 46206 |
| 91506 | AUGAT, INC. | 33 Perry Avenue<br>P.O. Box 779<br>Attleboro, MA 02703 |
| 91637 | DALE ELECTRONICS, INC. | 2064 12th Avenue<br>P.O. Box 609<br>Columbus, NE 68601<br>PHONE: 402-563-6301 |
| 91836 | KINGS ELECTRONICS COMPANY, INC. | 40 Marbledale Road<br>Tuckahoe, NY 10707<br>PHONE: 914-793-5000 |
| 92194 | ALPHA WIRE CORPORATION | 71 Lidgerwood Avenue<br>Elizabeth, NJ 07207<br>PHONE: 201-925-8000 |
| 95146 | ALCO ELECTRONIC PRODUCTS, INC. | 1551 Osgood Street<br>North Andover, MA 01845 |
| 95238 | CONTINENTAL CONNECTOR CORPORATION | 34-63 56th Street<br>Woodside, NY 11377<br>PHONE: 212-899-4422 |

| CODE | MANUFACTURER | ADDRESS |
|---|---|---|
| 95987 | WECKESSER COMPANY, INC. | Chicago, IL |
| 98291 | SEALECTRO CORPORATION | 225 Hoyt<br>Mamaroneck, NY 10544 |
| 99800 | AMERICAN PRECISION INDUSTRIES, INC. | Delevan Division<br>270 Quaker Road<br>East Aurora, NY 14052<br>PHONE: 716-652-3600 |
| Cage #<br>50829<br>A | SEMI CONDUCTOR CIRCUITS, INC. | 49 Range Road<br>Windham, NH 03087-2003 |